Mechanisms for Model Motor Cars

Meccano Clutches, Gear-Boxes and Differentials

By "Lock-Nut"

LAST month I described several types of steering mechanism suitable for Meccano model motor vehicles, and many model-builders have written to tell me that they found the suggestions outlined very helpful in building vehicles of all kinds. This month I am dealing with the arrangement of the various mechanisms by which the power of the driving motor is transmitted to the wheels.

Generally speaking, the transmission system of a car comprises three essential units. The first of these is the clutch, which serves the purpose of coupling the power unit to the gear-box that forms the second unit. Thirdly, there is the differential gear that transmits the final drive from the gear-box to the road wheels.

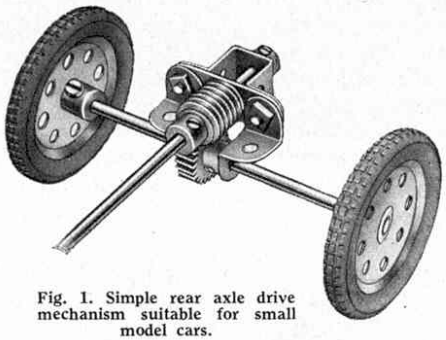

Fig. 1. Simple rear axle drive mechanism suitable for small model cars.

With the usual forms of clutch the drive is transmitted by bringing two surfaces into contact so that friction causes them to grip each other. The mechanism is placed between the engine crankshaft and the gear-box, so that the two can be disconnected to allow the driver of a car to change gear, and to stop his vehicle without stopping the engine.

One of the most simple types of clutch to reproduce in Meccano is shown in model form in Fig. 4 in which a Rubber Ring on Pulley 1 and the Flanged Wheel 3 are the two members that are engaged. The Pulley 1 fitted with the Rubber Ring is fitted on Rod 2 which represents the driving shaft. The Flanged Wheel rotates with Rod 4, the end of which is separated by a slight interval from that of Rod 2, and yet is free to slide along it. This is effected by means of two Angle Brackets, which are fixed to the Flanged Wheel but are spaced from it by Collars. The slotted holes of the Angle Brackets are occupied by the bolts that fasten Collar 5 to Rod 4. The Flanged Wheel 3 is held in engagement with the Ring on Pulley 1 by a portion of a Compression Spring 6, which is inserted in the position shown.

The withdrawal mechanism of this clutch may consist of suitable arms or "claws" resting on the flange of the Wheel 3 and engaging its rim, so that with the operation of a convenient hand or foot lever, the Wheel 3 can be forced back against the spring.

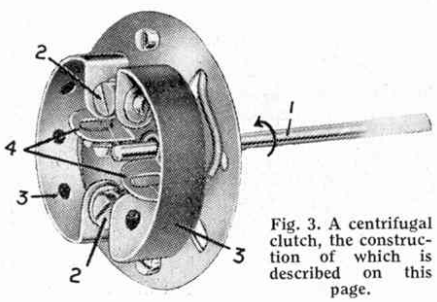

Fig. 3. A centrifugal clutch, the construction of which is described on this page.

A simple type of clutch can also be made in the following manner. A Bush Wheel free on the gear-box shaft is pressed against a 1" Pulley fitted with a Rubber Tyre by a Compression Spring. The Bush Wheel is rotated with its shaft by means of Flat Brackets fixed to a Collar, the Flat Brackets engaging with set screws held in the tapped holes of the Bush Wheel by lock-nuts. This unit acts only as a slip clutch, and when another gear is engaged in the gear-box the clutch slips and allows for the difference in speeds of the driving motor and gear-box shafts.

This arrangement can be adapted for operation by a foot pedal. For this purpose the 1" Pulley is replaced by a $\frac{3}{4}$" Flanged Wheel, inside the rim of which a circle of indiarubber is pressed. The withdrawal fork consists of two Pawls without bosses, which are locked on a Screwed Rod so that they can force the Bush Wheel back against the pressure of the Compression Spring.

A more compact type of clutch is the plate type, a model of which is shown in Fig. 2. This has what is known as a floating plate between the driving and driven members, and its operation is similar to that of the multi-plate clutches employed in certain modern cars.

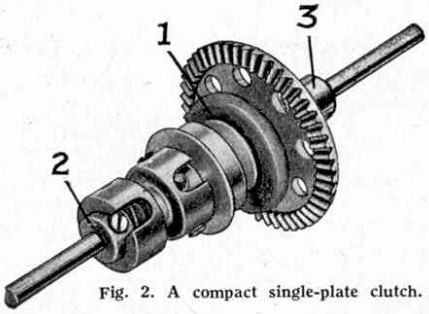

Fig. 2. A compact single-plate clutch.

The plate is represented by a $\frac{1}{2}$" loose Pulley fitted with an Aeroplane Constructor Rubber Tyre, and is free to rotate on the driven shaft. The Bevel Gear is free on its Rod, but is retained in position by Collar 3. The Gear is driven from the power unit of the model. The $\frac{3}{4}$" Flanged Wheel is gripped in a Socket Coupling but is free on the Rod. Collar 2 is arranged so that its grub screw engages with the slot in the Socket Coupling and thus turns it bodily with the Rod. The withdrawal mechanism consists of a fork that engages in the neck of the Socket Coupling, and it is built by fixing two 1" Screwed Rods in the end tapped bores of a Coupling, the latter being fixed on a shaft to which a suitable foot pedal is attached.

A very interesting special type of clutch is shown in Fig. 3. In this the clutch members, which resemble the shoes of an internal expanding brake, are kept in engagement by centrifugal force, and the clutch is controlled by altering the engine speed. Rod 1 is driven by the engine in the direction indicated by the arrow, and it carries a Face Plate. The Pivot Bolts 2 each carry a Collar and three Washers, the shoes 3 of the clutch being fixed to the Collars. The shoes are held lightly together by short pieces of Spring Cord, but move outward when the shaft 1 is rotating, and are then

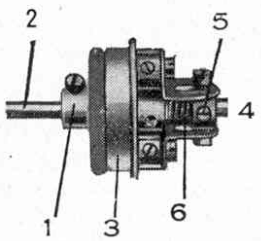

Fig. 4. A simple friction clutch.

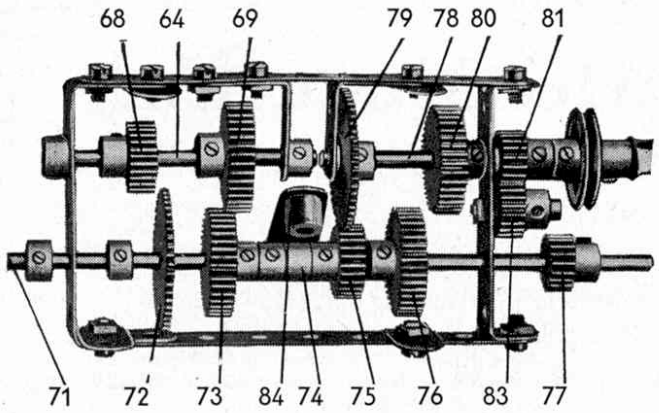

Fig. 5. This gear-box provides three forward speeds and a reverse movement.

forced into contact with the rim of a Boiler End fixed to the gear-box shaft. A free-wheel is incorporated in order to prevent the car from over-running the engine. This consists of two Angle Brackets 4, which are held in contact with a ½" Pinion on the driven shaft by Spring Cord.

No matter how small a model motor car is, a gear-box of some kind is necessary to make it realistic and interesting. The easiest type to build is one giving a single speed forward and one in reverse. This can be made by fixing a Contrate Wheel on the driving shaft of the Motor, and arranging a sliding Rod fitted with two Pinions so that moving it backward and forward allows either of the Pinions to be meshed with the Contrate Wheel.

Fig. 7 shows a gear-box that provides three speeds forward and one reverse, and is of particular interest on account of its extreme compactness. The end of the Rod 1 is inserted in the bore of the ½" Pinion 4 carried on a separate Rod 2, from which the final drive is taken. The Rod 2 also carries a ¾" Pinion and Collar. The sliding layshaft is a 4½" Rod, on which are a ½" Pinion 5, a ¾" Pinion 6, and a ½" Pinion 7. A ½" Pinion 8 is carried on a ¾" Bolt screwed into the transverse bore of a Threaded Boss and locked by means of a grub screw into the opposite end of the bore. The Threaded Boss is rigidly attached to the gear-box frame by a ½" Bolt 9, but is spaced by a Collar and two Washers.

The movement of the sliding shaft is controlled by a ⅜" Bolt 10, the head of which fits between the bosses of the Pinions 6 and 7. The Bolt is fixed in a Collar on the end of a 3" Rod forming the gear change lever, which is pivoted to a 1" Triangular Plate by a further Collar secured in place on the Rod by its grub screw. The latter Collar carries a bolt, the shank of which passes through one of the holes in the Triangular Plate. The Bolt is locked in position by a nut to allow the Rod to pivot freely. The first forward speed is shown in engagement in the illustration, the drive passing through the ½" Pinion on the driving shaft 1 to the ¾" Pinion 6 on the layshaft. The ½" Pinion 7 is engaged with the ¾" Pinion on the driven shaft, so that there are two stages of reduction gearing between driving and driven Rods. By sliding the layshaft to the right the Pinion 7 is disengaged, but Pinion 6 remains in engagement with its ½" Pinion and at the same time is brought into mesh with Pinion 4. This gives a straight through drive.

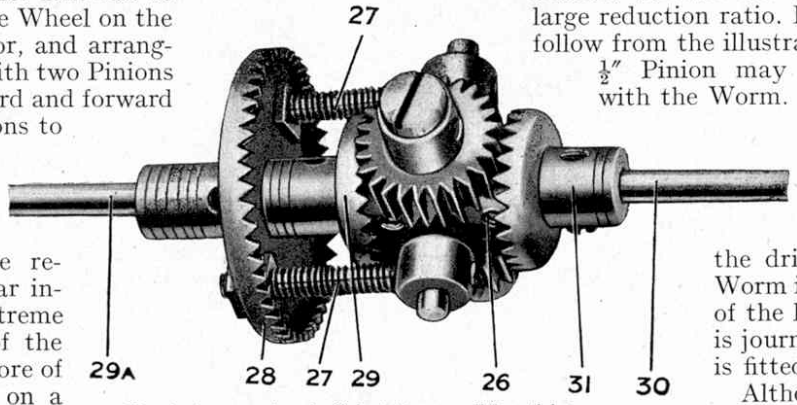

Fig. 6. A compact and efficient Meccano differential gear.

Further movement of the sliding Rod brings into engagement Pinions 3 and 5 and 6 and 4, thus providing two step-up stages for top gear. Reverse gear is obtained when the rod is slid over to the extreme left, for the drive then goes through Pinions 3 and 8, which are in constant mesh, to Pinion 6, Pinion 7 engaging the ¾" Pinion.

The gear-box shown in Fig. 5 gives the same number of forward speeds as the gear-box just described, but it is more bulky and provides a wider range of gear ratios. It is suitable for incorporation in large models of heavy construction where a wide choice of gear-ratios is an advantage. The operation is exactly the same as the small gear-box shown in Fig. 7.

Gear changing is effected by Crank 84, which is pivotally attached by its slotted hole to Collar 74 and forms the selector arm. Its boss should be fixed on a Rod placed across the chassis of the model in which it is incorporated. A suitable gear lever can then be fixed to the Rod.

The final drive from the gear-box can be transmitted to the rear axle in several ways. A simple arrangement such as a ½" Pinion driving a Contrate Wheel fixed to the rear axle or any other system of gears producing a right angle drive can be used, and in small models arrangements of this kind are entirely satisfactory. Another useful type of rear axle drive is illustrated in Fig. 1, and is of particular interest because the worm drive gives a fairly large reduction ratio. Its construction is easy to follow from the illustration, and either a ¾" or a ½" Pinion may be used in conjunction with the Worm.

An alternative construction is to connect two 1¼" Discs by means of 1½"×½" Double Angle Strips, and to journal the driving shaft, to which the Worm is fixed, in the centre holes of the latter parts. The rear axle is journalled in the 1¼" Discs and is fitted with a ½" Pinion.

Although devices of this kind are satisfactory for some model-building purposes, in actual practice a solid axle is never used except on certain types of light cars. The reason for this is that when a car is turning in a circle the inner wheel tends to move more slowly than the outer wheel because it travels through a shorter arc. With the two fixed to the axle one of them therefore would drag or skid when turning. In order to allow each of the rear wheels to rotate at different speeds and still transmit the drive when a car is turning corners, it is necessary to introduce a special type of gearing in the rear axle, which is built in two parts. This gearing is the differential. A Meccano differential gear of compact design suitable for inclusion in model cars of all types is shown in Fig. 6. It should be enclosed in a casing consisting of Boiler Ends joined by 2" Strips.

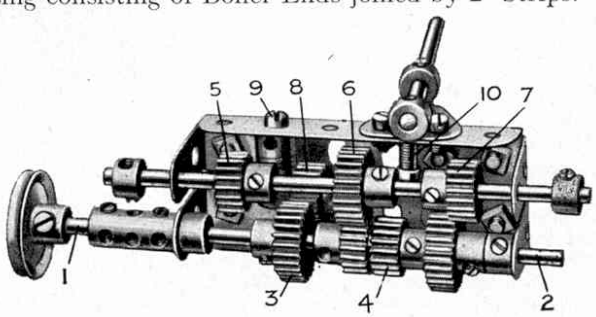

Fig. 7. One of the smallest three-speed and reverse gear-boxes yet constructed from Meccano parts.

New Outfit Models

Rocking Horse—Gymnast—Electric Van—Tractor

THE four simple models illustrated on this and the opposite page are constructed with Outfits Nos. 0, 2, 3, and 4, and model-builders should have little difficulty in building them up with the aid of the accompanying description. The first model to be dealt with is an amusing rocking horse, which is driven by a *Magic* Motor and rocks backward and forward when the Motor is set in motion. The model is shown in Fig. 1 and is built from parts contained in Outfit No. 0.

The body of the horse consists of a *Magic* Motor, to which two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and a $2\frac{1}{2}''$ Strip are attached to form the two hind legs and one of the fore-legs. The second fore-leg is built up from two Flat Brackets, and is fastened to a lug of the *Magic* Motor by an Angle Bracket. Two $5\frac{1}{2}''$ Strips curved as shown are secured to the lower ends of the legs to form rockers.

Two Flat Trunnions placed together represent the horse's head, and its "neck" consists of two $2\frac{1}{2}''$ small radius Curved Strips.

The mechanism for rocking the model to and fro is very simple and consists of a $5\frac{1}{2}''$ Strip 2 loosely attached to one of the hind legs by a bolt held in place by two nuts. The Strip 2 is connected by means of a $2\frac{1}{2}''$ Strip 1 to a Bush Wheel fixed on the winding spindle of the *Magic* Motor. As the spindle of the Motor revolves, the Strip 2 is moved up and down so that the horse is first rocked backwards as the Strip presses against the floor, and then rocks forward under its own weight as the Strip rises. The Strips 1 and 2 are bent slightly so that they do not jam against any part of the model.

Parts required to build model rocking horse: 3 of No. 2; 4 of No. 5; 3 of No. 10; 3 of No. 12; 1 of No. 24; 21 of No. 37a; 16 of No. 37b; 2 of No. 48a; 2 of No. 90a; 2 of No. 111c; 2 of No. 126a; 1 *Magic* Motor (not included in Outfit No. 0).

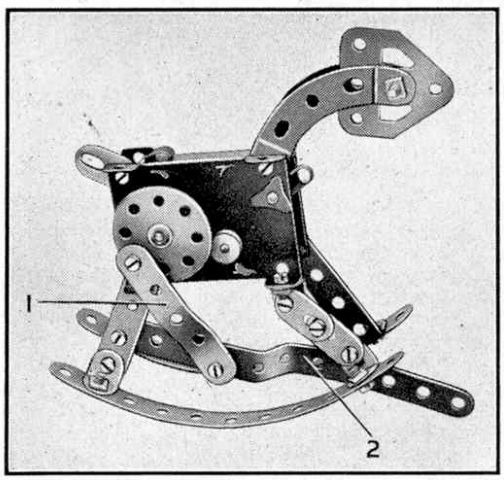

Fig. 1. When the Magic Motor of this Outfit No. 0 rocking horse is started, the model rocks backwards and forwards.

The model tractor and disc harrow illustrated in Fig. 2 are based on actual machines used on many farms for aerating and loosening the surface soil of cultivated fields. They are constructed from the contents of Outfit No. 3. The chassis of the tractor consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and construction is commenced by overlapping two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates by two holes and attaching them at one end of the Plate by a Trunnion. The Flexible Plates form part of the radiator, which is completed by bolting a $2\frac{1}{2}''$ small radius Curved Strip to the upper Flexible Plate. The top of the engine bonnet is formed by two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, which are bolted together overlapping three holes. The ends of the Plates are then bent as shown in the illustration, and they are attached to the Curved Strip of the radiator by an Angle Bracket. A $2\frac{1}{2}''$ Curved Strip is attached to the rear end of the bonnet by another Angle Bracket, and is supported from the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate by two $2\frac{1}{2}''$ Strips and Angle Brackets.

The engine unit is represented by two $1\frac{11}{16}''$ radius Curved Plates, which are bolted together overlapping two holes and are secured to the chassis under the bonnet by an Angle Bracket.

The rear wheels of the tractor are two Road Wheels fastened on a $3\frac{1}{2}''$ Rod passed through the flanges of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, but before they are fitted in position the mudguards are constructed. The latter consist of two 3" Formed Slotted Strips 2, attached by Angle Brackets to the Semi-Circular Plates 1 that are bolted to the Flanged Plate. The front wheels are formed by two $1\frac{1}{4}''$ Discs, which are mounted by $\frac{3}{8}''$ Bolts on two Flat Brackets bolted to the front of the chassis. The bolts attaching the Flat Brackets to the chassis are passed through the slotted holes of the Brackets, so that it is possible to adjust the position of the front wheels, to bring the chassis of the tractor into a horizontal position.

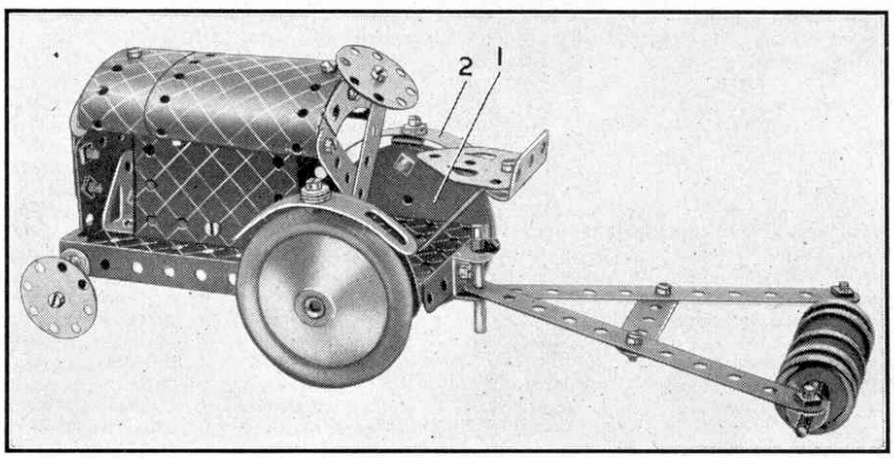

Fig. 2. This realistic model of a tractor and disc harrow is constructed from the contents of Outfit No. 3.

The driver's seat is constructed from a Flat Trunnion and a Trunnion, and is supported by a $2\frac{1}{2}''$ Strip from the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. To the front flange of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate a Flat Bracket carrying a $\frac{3}{8}''$ Bolt in its free hole, is bolted to represent the starting handle.

The frame of the disc harrow consists of two $5\frac{1}{2}''$ Strips which are joined at the sixth holes from their forward ends by a $2\frac{1}{2}''$ Strip, as shown in the illustration. Angle Brackets are bolted to the rear ends of the $5\frac{1}{2}''$ Strips and they form bearings for a 4" Rod that carries three 1" fast Pulleys, two 1" loose Pulleys and two $\frac{3}{4}''$ Discs representing the discs of the harrow. The $\frac{3}{4}''$ Discs and 1" loose Pulleys are spaced apart by Spring Clips.

The coupling hook by which the harrow is attached to the tractor consists of a Double Bracket bolted to the rear flange of the Plate forming the chassis of the tractor. The forward ends of the $5\frac{1}{2}''$ Strips of the harrow are placed between the lugs of the Double Bracket, and then secured to it by a $1\frac{1}{2}''$ Rod. The Rod is prevented from slipping out of position by a Spring Clip.

Parts required to build model tractor and harrow: 2 of No. 2; 4 of No. 5; 2 of No. 10; 1 of No. 11; 8 of No. 12; 1 of No. 15b; 1 of No. 16; 1 of No. 18a; 2 of No. 22; 2 of No. 22a; 6 of No. 35; 47 of No. 37a; 41 of No. 37b; 1 of No. 52; 2 of No. 90a; 2 of No. 111c; 1 of No. 125; 1 of No. 126; 1 of No. 126a; 2 of No. 187; 2 of No. 188; 2 of No. 191; 2 of No. 199; 2 of No. 214; 2 of No. 215; 2 of No. 217a; 2 of No. 217b.

A good example of the use of Flexible Plates in reproducing streamlined vehicles is given by the model electric van shown in Figs. 3 and 4. This model is built with the contents of Outfit No. 4 and is fitted with a No. 1 Clockwork Motor, which drives it along at a good speed. The chassis of the van consists of two $12\frac{1}{2}''$ Strips 2, placed with their flat sides vertical and joined at their centres by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate 1, and at their rear ends by a $5\frac{1}{2}''$ Strip and two Angle Brackets. The Flanged Plate 1 forms part of the floor of the van, the remainder of the floor being filled in by two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flexible Plates. The rear Flexible Plate is connected for support to the Flanged Plate 1 by an Angle Bracket and to the $5\frac{1}{2}''$ Strip by two Flat Brackets. The other Flexible Plate is bolted directly to the Flanged Plate 1, overlapping it one hole.

To each Strip 2 are bolted one $5\frac{1}{2}'' \times 1\frac{1}{2}''$, one $2\frac{1}{2}'' \times 1\frac{1}{2}''$ and one $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate in that order commencing from the rear end of the model. On each side of the van a gap of $2\frac{1}{2}''$ is left between the $2\frac{1}{2}'' \times 1\frac{1}{2}''$

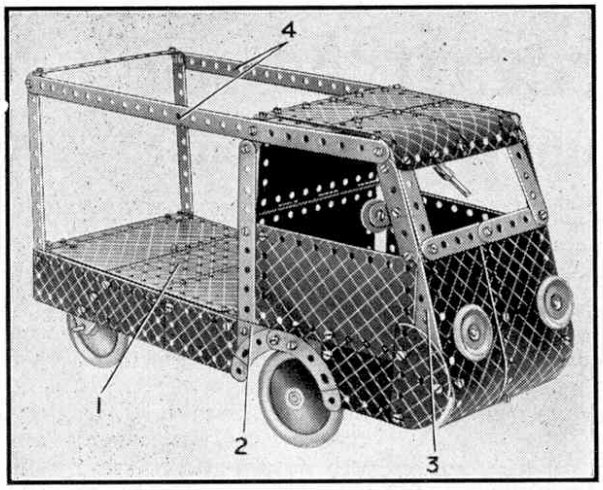

Fig. 3. An attractive and detailed model of a streamlined electric van built with Outfit No. 4.

and the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, and this is partially filled in by a $2\frac{1}{2}''$ small radius Curved Strip.

To the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate are secured a Semi-Circular Plate and a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate. These two parts form a portion of the side of the cab, which is completed by adding a $5\frac{1}{2}''$ Strip behind the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate and a compound strip 3. The latter consists of a $3\frac{1}{2}''$ Strip extended by a $2\frac{1}{2}''$ Strip, and its lower end is bolted to the Semi-Circular Plate. The $5\frac{1}{2}''$ Strip and the compound strip 3 are each secured to a $12\frac{1}{2}''$ Strip 4 at their upper ends by a Flat Bracket. This is repeated on the other side of the van. The Strips 4 form the top of the framework of the body and are joined at their rear ends by a $5\frac{1}{2}''$ Strip and two Angle Brackets, the bolts holding also two further $5\frac{1}{2}''$ Strips, the lower ends of which are secured to the chassis.

The front of the cab is built up from two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates and two U-Section Curved Plates, which are bolted together as shown and secured in position by Angle Brackets. The windscreen frame, which is formed by four $2\frac{1}{2}''$ Strips, is next added and is followed by the roof of the cab. The latter consists of two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates and two $1\frac{11}{16}''$ radius Curved Plates, the forward edge of the compound plate being bolted to the windscreen frame and the rear edge to a $5\frac{1}{2}''$ Strip fastened by Angle Brackets between Strips 4. A Hinged Flat Plate closes in the rear of the cab, but is not fitted in position until the steering mechanism has been assembled.

The steering mechanism is shown in Fig. 4. It is mounted on two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips 5, which are fastened together at their inner ends by a bolt carrying four washers to space the Double Angle Strips apart. The compound double angle strip so formed is bolted between the Strips 2 of the chassis in the sixth holes from their forward ends. A Double Angle Strip 6, which carries at one end a Reversed Angle Bracket, is then secured to the Double Angle Strip 5 by two Trunnions. On one of the Reversed Angle Brackets a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 7 and a Double Bracket are mounted pivotally by a lock-nutted bolt, and the other carries a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 8 and a Double Bracket. The holes in the lugs of the Double Bracket provide bearings for the $1\frac{1}{2}''$ Rods forming the stub axles for the front Road Wheels. The $1\frac{1}{2}''$ Rods are each held in position by a Spring Clip.

The Double Angle Strips 7 and 8 are joined, as shown in Fig. 4, by two $2\frac{1}{2}''$ Strips overlapped three holes. The bolts joining the Double Angle Strips to the compound strip are lock-nutted so that the Double Angle Strips are still free to move. The forward end of the Double Angle Strip 8 is also connected by a compound strip 9, consisting of a $2\frac{1}{2}''$ Strip and a Flat Bracket, to a Bush Wheel on the bottom of the steering column. The Bush Wheel carries also a $\frac{3}{8}''$ Bolt fastened in position by two nuts, which prevent the wheels being turned too far in one direction so that the steering is locked.

The steering column is a 4" Rod passed through a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate 10 bolted to one of the Double Angle Strips 5, and it carries at its upper end a 1" Pulley complete with Rubber Ring to represent the steering wheel. Additional support for the steering column is provided by a Cranked Bent Strip attached to the Plate 10. Two Spring Clips prevent the steering column from sliding in its bearings.

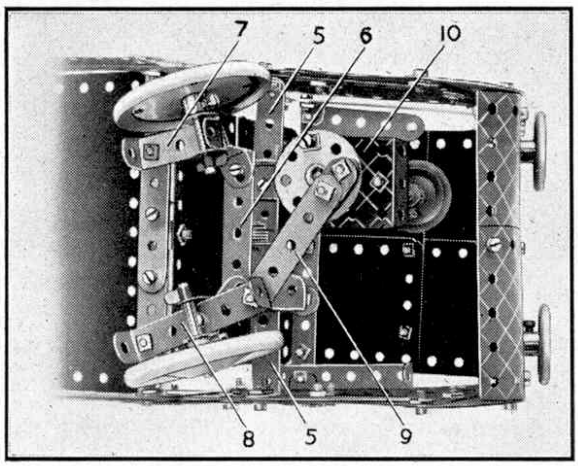

Fig. 4. An underneath view of the front of the electric van shown in Fig. 3.

All that now remains to be done is to complete the cab and fit the rear axle. The Hinged Flat Plate forming the back of the cab is fitted in position by Angle Brackets, and the headlights, windscreen wiper and mirror are then added. The mirror is a $\frac{3}{4}''$ Disc supported by an Obtuse Angle Bracket from one of the Strips 3, and the windscreen wiper consists of a 1" Rod secured to the windscreen frame by a Rod and Strip Connector. The headlights are two 1" Pulleys complete with Rubber Rings and they are mounted on the shanks of two $\frac{3}{8}''$ Bolts passed through the front of the cab.

The rear axle is formed of a 2" and a 4" Rod, joined by a Rod Connector. It carries a 1" Pulley, and revolves in Flat Trunnions attached to the $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates that are bolted to the sides of the chassis. The two Road Wheels on the rear axle are each spaced from the Flat Trunnions by two Washers so that they do not rub against the bolts holding the Flat Trunnions in position.

The method of mounting the No. 1 Clockwork Motor to drive the van is as follows. A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is fastened by means of its turned-up ends between the longer flanges of the Flanged Plate 1 forming part of the floor of the van. The Double Angle Strip is 4" from the off side of the van, that is, the side seen in Fig. 3. The Clockwork Motor is bolted to the Double Angle Strip so that its control lever points forward. The 1" Pulley on the rear axle is connected by a $2\frac{1}{2}''$ Driving Band to the bare driving shaft of the Clockwork Motor. The Driving Band is prevented from slipping off the driving shaft by a 1" Pulley.

Parts required to build model electric van: 4 of No. 1; 8 of No. 2; 2 of No. 3; 9 of No. 5; 5 of No. 10; 2 of No. 11; 8 of No. 12; 4 of No. 12c; 2 of No. 15b; 1 of No. 17; 2 of No. 18a; 1 of No. 18b; 2 of No. 22; 1 of No. 24; 4 of No. 35; 75 of No. 37a; 81 of No. 37b; 4 of No. 38; 1 of No. 44; 1 of No. 48; 6 of No. 48a; 1 of No. 51; 1 of No. 52; 4 of No. 90a; 2 of No. 111c; 2 of No. 125; 2 of No. 126; 2 of No. 126a; 3 of No. 155a; 1 of No. 186a; 4 of No. 187; 2 of No. 188; 2 of No. 189; 4 of No. 190; 2 of No. 191; 2 of No. 192; 1 of No. 198; 2 of No. 199; 2 of No. 200; 1 of No. 212; 1 of No. 213; 2 of No. 214; 1 of No. 217b. 1 No. 1 Clockwork Motor (not included in Outfit).

An amusing and attractive model for owners of an Outfit No. 2 or one larger is the performing gymnast shown in Fig. 5. Its construction is commenced by building up the base, which consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, to the flanges of which are bolted two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates and two compound plates, each consisting of a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ and a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate. The edges of the compound plates are then braced by $2\frac{1}{2}''$ and $5\frac{1}{2}''$ Strips.

The next step in the construction is to bolt two $5\frac{1}{2}''$ Strips in a vertical position to the centres of the longer flanges of the Flanged Plate. These Strips are supported by two $2\frac{1}{2}''$ small radius Curved Strips arranged as shown in the illustration. A $3\frac{1}{2}''$ Rod is passed through the upper end holes of the $5\frac{1}{2}''$ Strips and this forms the bar around which the gymnast pivots. The Rod is fitted with a Bush Wheel between the $5\frac{1}{2}''$ Strips, and at one end carries a 1" Pulley, which is connected by a belt of Cord to a 1" Pulley on a Crank Handle journalled in the base.

The body of the gymnast is represented by a Flat Trunnion, and in the hole at the narrow end of this part two Flat Brackets and an Angle Bracket are bolted.

Parts required to build model gymnast: 4 of No. 2; 6 of No. 5; 4 of No. 10; 8 of No. 12; 1 of No. 16; 1 of No. 19g; 2 of No. 22; 1 of No. 24; 2 of No. 35; 38 of No. 37a; 36 of No. 37b; 1 of No. 52; 2 of No. 90a; 1 of No. 111c; 1 of No. 126; 1 of No. 126a; 2 of No. 188; 2 of No. 190; 2 of No. 191.

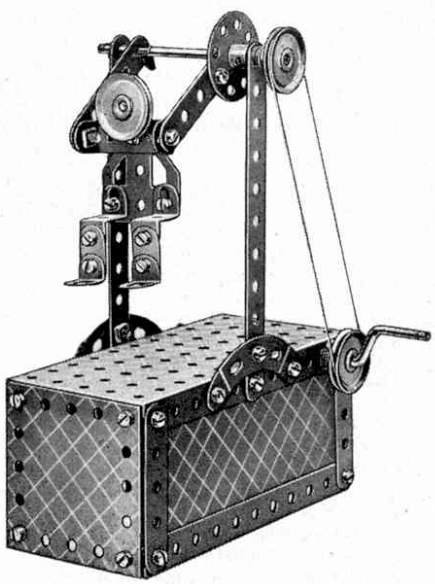

Fig. 5. Outfit No. 2 is all that is required to construct this amusing working model of a gymnast.